McKinsey & Company

A government blueprint to adapt the ecosystem to automation and the Future of Work

Digital and artificial intelligence technologies will likely have a substantial economic and social impact. Governments can act now to create shared prosperity and better lives for all citizens.

January 2020

Cover image:
© Sean Gladwell/Getty Images

Copyright © 2020 McKinsey & Company. All rights reserved.

This publication is not intended to be used as the basis for trading in the shares of any company or for undertaking any other complex or significant financial transaction without consulting appropriate professional advisers.

No part of this publication may be copied or redistributed in any form without the prior written consent of McKinsey & Company.

Table of contents

2 In brief

3 Automation: A positive disruption that can improve the lives of everyone

6 A world in transition: Three challenges that stand in the way of greater prosperity

10 A blueprint for a smooth, win–win Future of Work transition

In brief

Digital and artificial intelligence (AI) technologies will likely have a substantial economic and social impact—and governments will by no means be passive observers. On the contrary, they can act now to create shared prosperity and better lives for all citizens. In this report on the role of governments in adapting to the Future of Work, we describe the potential benefits of a technological disruption, discuss active management of the workforce transitions to avoid creating a lose–lose (or win–lose) scenario, and provide a framework that governments can use to develop a road map to a win–win transition.

— *Automation can be a positive disruption that improves everyone's lives.* Automation can enhance healthcare, education, traffic, and emergency response. It can reduce workplace hazards, make housing more affordable, protect the environment, and benefit consumers in numerous ways. It can improve job satisfaction and make labor markets more flexible. At the same time, it can increase productivity growth, which may soon be the only driver of economic growth in many mature economies.

— *Three challenges stand in the way of this opportunity: a shortage of skills, inequality, and a potential backlash against automation.* First, too few workers possess the skills needed for full technology adoption. As a result, the uptake of technology remains behind its current potential. And for those displaced from their jobs, skills obsolescence may lead to an involuntary exit from the workforce. Second, without reforms, research suggests that the Future of Work will be less inclusive and more unequal. Besides the social implications, a vicious cycle can arise from increasing inequality: aggregate demand falls as income and wealth accumulates among high earners with low propensity to consume; companies invest less and create fewer new jobs; and productivity stagnates along with wages, ultimately leading to even lower aggregate demand. Third, fear of automation, sometimes intensified by a populist backlash, could turn the public against it and result in government inaction or resistance that further hinders innovation-based growth.

— *A blueprint can help governments create a smooth, win–win transition to automation.* Governments can develop national strategies to foster technology adoption, with an emphasis on enabling regulation, ensuring a faster and better digital infrastructure, and building a robust innovation ecosystem. Governments can reform the human capital development system from early childhood to adult training and encourage lifelong learning. They can also strengthen and upgrade social protection systems to ensure that no one is left behind and to restore the virtuous cycle in which higher productivity leads to increased wages and aggregate demand, and vice versa. Most broadly, they can convene, coordinate, and mobilize all stakeholders toward this transition.

Automation: A positive disruption that can improve the lives of everyone

By Marco Dondi, Solveigh Hieronimus, Julia Klier, Peter Puskas, Dirk Schmautzer, and Jörg Schubert

Automation has the potential to alter nearly every facet of work and daily life (see sidebar "Automation defined"). While much has been made of the potentially adverse effects, our research has highlighted several benefits.

Improving life and making work more pleasant

Automation, digital, and AI technologies are already essential to our professional and civic lives. Applications vary widely, from improving healthcare and education, to protecting the environment, to empowering the consumer, to making the workplace safer (see sidebar "Areas in which digital technologies and artificial intelligence are improving life").[1]

Growing the economy …

The McKinsey Global Institute (MGI) identified the adoption of digital technologies as the biggest factor in future economic growth:[2] it accounts for about 60 percent of potential productivity growth by 2030.[3] AI alone is expected to yield an additional 1.2 percent per year in productivity growth from 2017 to 2030. By comparison, the steam engine led to productivity growth of about 0.3 percent per year from 1850 to 1910, the application of robots to manufacturing generated 0.4 percent each year, and the introduction of information and communication technologies and early digital technologies in the 2000s produced an estimated 0.6 percent each year.[4]

… in a context of declining growth of productivity and working adults

The world needs a boost to productivity. Despite the contributions from the ICT revolution, productivity growth in mature economies has declined since the 1970s. In the G7 countries, productivity growth fell from almost 3 percent in the 1970s to about 2 percent in the 1980s and 1990s to approximately 1 percent

Sidebar

Automation defined

This report uses "automation" in a broad sense to include any advance in computer technology that reduces the need for human labor to produce the same output. Some technology applications would lead to physical or digital robots fully performing activities that previously required humans (for example, chatbots, self-driving cars, and automated warehouses or grocery stores). Others reduce the human labor needed by enabling new business models (for example, 3-D printing of houses, digital training, and e-commerce). Both can bring significant social and economic value. Digital technologies and artificial intelligence are critical to further automation, so this report focuses on them when discussing automation trends and impact.

Sidebar

Areas in which digital technologies and artificial intelligence are improving life

It is beyond the scope of this report to detail how new technologies are changing our lives, but examples of applications are already in use.

Healthcare. Artificial intelligence can diagnose some diseases better than physicians can. For example, a deep–learning convolutional neural network surpassed professional dermatologists at identifying cancerous skin lesions by visual examination alone.[1] Furthermore, robots can make more precise cuts than expert surgeons and cause less damage.[2]

Education. Technology is broadening access to education, enabling customized or mastery-based instruction and refocusing teachers' time on facilitation, coaching, and mentorship.[3] In one case, students in the Breakthrough School Models for College Readiness program of Next Generation Learning Challenges received personalized blended learning in mathematics and improved three percentage points more than a comparison group.[4]

Environment. Smart buildings use sensors and data analytics to improve energy management; at Google's data centers, for example, DeepMind Technologies helped cut the cooling bill by up to 40 percent.[5] Likewise, air pollution in Beijing fell by 20 percent after air-quality sensors that regulated traffic and construction according to the pollution level were installed.[6]

Retail. Consumers benefit from online platforms that provide price transparency, ease of access, and direct delivery. For example, sites MoneySupermarket and Skyscanner help shoppers compare prices. And in Ghana and Rwanda, drones deliver medicine and vaccines, with the larger goal of providing essential medical products anywhere in the countries within 15 minutes.[7]

Gig economy. Independent work has become easier via online platforms that improve job-matching or enable ride-hailing, home-sharing, freelancing, e-commerce, and many other areas. Between one-quarter and one-third of people in advanced economies engage in independent work—to complement or substitute for a more traditional source of income—and about 70 percent of this group do so by choice.[8]

Housing. With 3-D printing speeding up construction and making it cheaper and more flexible, homes could become more affordable.[9] For instance, construction technology company ICON and housing nonprofit New Story built a 350-square-foot home in 48 hours with 3-D printing at a cost of $10,000, compared with $25,000 if built traditionally.[10]

Workplace safety. In oil fields, robots now go underwater to repair gas pipelines, and drones conduct pipeline inspections.[11] After Tyson Foods deployed virtual-reality training, the company experienced a 20 percent reduction in injuries and illnesses.[12] Recycling plants are starting to automate garbage sorting with machines that are twice as fast as people and make no mistakes.[13]

---

1 Agence France Presse, "Computer learns to detect skin cancer more accurately than doctors," Guardian, May 29, 2018, theguardian.com.
2 Eliza Strickland, "In flesh-cutting task, autonomous robot surgeon beats human surgeons," IEEE Spectrum, October 13, 2017, spectrum.ieee.org.
3 Jake Bryant, Christine Heitz, Saurabh Sanghvi, and Dilip Wagle, "How artificial intelligence will impact K–12 teachers," January 2020, McKinsey.com.
4 Matthew D. Baird et al., "Informing progress: Insights on personalized learning implementation and effects," RAND Corporation, July 2017, rand.org.
5 Richard Evans and Jim Gao, "DeepMind AI reduces Google data centre cooling bill by 40%," DeepMind, deepmind.com.
6 For more, see "Smart cities: Digital solutions for a more livable future," McKinsey Global Institute, June 2018.
7 Adele Peters, "The world's largest drone delivery network is launching in Ghana," Fast Company, April 24, 2019, fastcompany.com.
8 For more, see "Independent work: Choice, necessity, and the gig economy," McKinsey Global Institute, October 2016.
9 Sophie Hirsch, "The first 3D-printed neighborhood will be sustainable and affordable, and it's breaking ground this year," Green Matters, March 2019, greenmatters.com.
10 Aria Bendix, "These 3D-printed homes can be built for less than $4,000 in just 24 hours," Business Insider, March 12, 2019, businessinsider.com.
11 Scott Nyquist and Jonathan Woetzel, "How the natural resources business is turning into a technology industry," Harvard Business Review, June 2, 2017, hbr.org.
12 *The Feed Blog,* "Better reality through virtual reality: Looking to the future of workplace safety," blog entry by Amy Vinson, October 23, 2018, thefeed.blog.
13 John Murawski, "Recycling centers roll out AI-trained robots," Wall Street Journal, July 5, 2019, wsj.com.

Simply to sustain historic economic growth rates, many countries will need to more than double productivity growth.

in the 21st century.[5] This slowdown is occurring in a context of declining population growth, with several Organisation for Economic Co-operation and Development (OECD) countries facing a shrinking workforce. By 2050, one-third of people in advanced economies will be aged 60 and over, along with a fifth of people in emerging economies.[6] Productivity growth will need to shoulder the burden of economic growth in many mature economies. Simply to sustain historic economic growth rates, many countries will need to more than double productivity growth. In this context, the productivity boost from AI is necessary to avoid negative consequences of slow growth such as lower income growth, increasing inequality, and difficulty for corporations and households to repay loans.

While automation may be promising for income growth, many of the world's workers are intensely worried that new technologies—AI, in particular—will disrupt their lives. The challenging transition to a more automated society may explain the discrepancy between future benefits and citizens' present concerns.

A world in transition: Three challenges that stand in the way of greater prosperity

While automation has the potential to boost economic growth, it poses some key challenges to the nature of work. The public senses this shift: job security is a major concern for many people around the world. A recent survey of 100,000 citizens in 29 countries found that job security was their number-one economic priority for the future (Exhibit 1). In this section, we outline three of the challenges linked to automation: skills, inequality, and deliberate efforts to hinder automation.

Challenge one: Shifting skill requirements

The path toward greater prosperity requires a growing number of talented individuals who can enable faster digital and AI adoption as well as large-scale upskilling and reskilling of the workforce to operate in a more digital and automated environment. Without filling this skill demand, technology adoption could slow, and people with obsolete skills could exit the labor force.

Profiles such as data scientist and technology translator are in short global supply, yet they're vital to widespread digital and AI adoption.[7] Data scientists, data engineers, software engineers, developers, and similar roles can deploy the technologies, and translators can identify opportunities for adoption and coordinate digital and business workers.

Exhibit 1

Citizens across the world say job security is their top economic priority for the future.

Economic priorities, % of people for whom this is a top 2 response

High Low

	Job security	Increased cost of living	Reducing income inequality	Access to financing (eg, mortgages, loans)	Employee training and reskilling
Africa	56	43	34	29	37
Asia	60	41	41	30	28
Europe	61	38	49	27	25
MENA[1]	57	43	34	24	41
North America	55	48	35	25	36
Oceania	61	54	32	26	28
South America	51	39	50	24	37
World average	58	42	40	29	31

[1] Middle East and North Africa.

The adoption of digital and AI technologies will also require most workers to upskill or reskill. Businesses are already struggling to find people that can work with digital technologies. In Germany, for example, interviews with managers and human resource departments suggest that, by 2023, the labor market will have a gap of about 450,000 workers who are able to perform complex data analysis.[8] But it is skills obsolescence that is fueling citizens' job security concerns.

Previous MGI research found the occupational mix by 2030 could shift toward occupations requiring university degrees and toward activities requiring technological and socioemotional skills.[9] Up to 14 percent of people globally may need to change occupations by then, a figure that could climb above 30 percent in more advanced economies with a faster pace of automation.[10]

This picture concerns the millions of older workers employed as drivers, cashiers, miners, bank tellers, mail carriers, dispatchers, or lumberjacks, whose age and starting skill levels might limit their opportunities to adapt.[11] Furthermore, reskilling is hard to do well at scale. Evidence from US workforce development programs suggests that such efforts have, historically, been largely ineffective.[12]

And if unaddressed, the financial and psychological challenges required could present a significant socioeconomic downside to rapid technological adoption—even for those who *can* successfully reskill.[13]

Challenge two: Rising inequality

Most, if not all, research studies expect that, without reforms, the Future of Work will be less inclusive and more unequal (Exhibit 2).

The trend of increasing inequality within countries has been visible for some decades now.[14] The OECD studied the decoupling of wage growth from productivity, underpinning the reduction of labor's share of income, and identified the rise of low labor–intensive technology firms as the most important factor.[15] Middle-income households in OECD countries have seen their aggregate share of income decline from approximately four times that of upper-income households in 1985 to less than three times by 2015.[16]

Technological adoption could increase economic polarization. The rapid increase in demand for highly skilled workers would see their wages raised further, while low- and middle-skill workers would see their demand and wages reduced. AI adoption is also expected to unequally affect companies' profitability: early movers could more than double their profits by 2030, while late adopters could slash employment and investments and still witness a decline in profits.[17] Polarization among cities and countries could also rise, with AI implemented faster in some Chinese or American cities than in others.

Narrowly concentrated benefits of technology adoption can ignite a vicious cycle, leading to lower growth and job creation. For example, MGI expects 400 million to 800 million jobs to be displaced by 2030, with economies potentially creating 590 million new jobs—and perhaps as many as 890 million—if the pace of

Exhibit 2

Studies on future income distribution tend to show greater inequality and less inclusivity.

● More unequal ● Neutral

Author(s)/organization	Title, year	Impact of AI-driven automation on income distribution
Daron Acemoglu and Pascual Restrepo	"Artificial intelligence, automation and work," 2019	●
	"Automation and new tasks: How technology displaces and reinstates labor," 2019	●
	"The race between machine and man: Implications of technology for growth, factor shares and employment," 2018	● ●
Erik Brynjolfsson and Andrew McAfee	*Race against the machine: How the digital revolution is accelerating innovation, driving productivity, and irreversibly transforming employment and the economy*, 2011	●
Richard B. Freeman	"Who owns the robots rules the world," 2015	●
David Hémous and Morten Olsen	"The rise of the machines: Automation, horizontal innovation and income inequality," 2013	●
Anton Korinek and Joseph E. Stiglitz	"Artificial intelligence and its implications for income distribution and unemployment," 2017	●
International Monetary Fund	"Should we fear the robot revolution? (The correct answer is yes)," 2018	●
	"Robots, growth and inequality," 2016	●
Organisation for Economic Co-operation and Development	"Less income inequality and more growth—are they compatible? Part 2. The distribution of labour income," 2012	●
	"Divided we stand: Why inequality keeps rising," 2011	●
World Bank Group	"The Future of work: Race with—not against—the machine," 2018	●
McKinsey Global Institute	*Notes from the AI frontier: Modeling the impact of AI on the world economy*, 2018	●

public and private investments increases.[18] However, up to 365 million of these new jobs depend on the benefits of productivity growth leading to rising incomes that generate higher aggregate demand. It is the growth in aggregate demand that would spark the positive cycle of investments and higher employment.[19] But if income growth is concentrated among high earners with a very low marginal propensity to consume, aggregate demand would stagnate and drag business investments and job creation. This cycle has already undermined the growth potential of many OECD economies.[20]

In the past two decades, economists have also observed investment shifting from technologies that complement labor to those that substitute for it. This move is consistent with a greater focus on cutting costs than on creating employment or on increasing the supply and quality of goods and services.[21] Should current trends continue, the effort to achieve and maintain full employment may face higher hurdles than previously thought.

Challenge three: Backlash against technology?

Concerns over shrinking job security and growing inequality have already led some governments to take measures to slow the pace of automation. Backlash against platforms is one example, with many governments limiting new, more productive business models such as ride-hailing apps and house-sharing platforms to protect employment in traditional taxis and hotels. In another example, the government of South Korea has scaled back its incentives for companies to invest in automation technologies, which were previously introduced to boost productivity.[22] Bill Gates, Robert J. Shiller, and other notable business

leaders and economists have proposed taxes on robots to raise revenues, with the intent of protecting displaced workers but with the potential side effect of reducing automation investments.

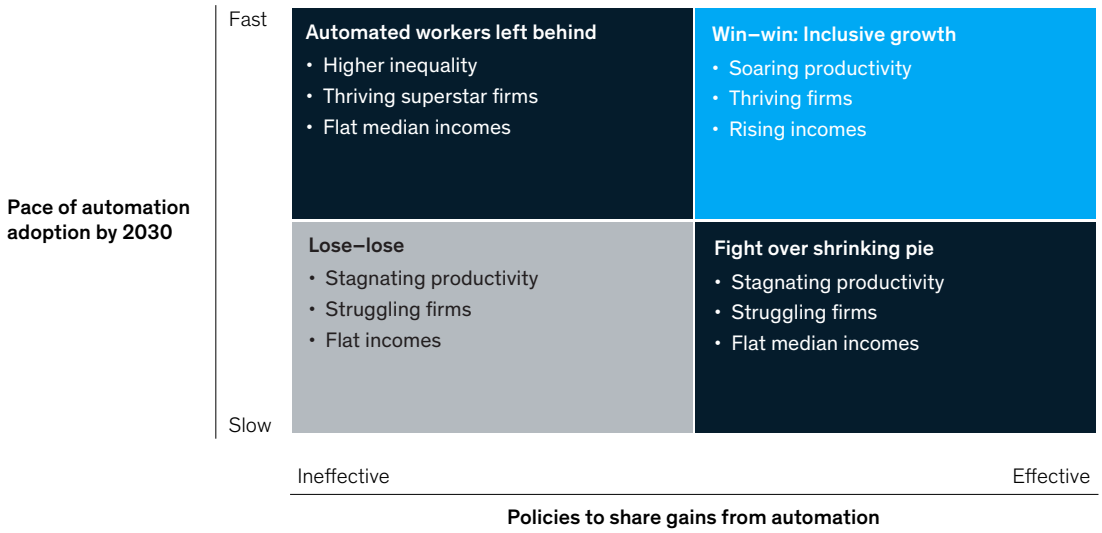
Hostility toward automation would significantly hinder productivity and prosperity growth. An MGI simulation of such a scenario for countries in the European Union found the resulting increase in imports and decrease in exports would almost eliminate EU growth from 2018 to 2030.[23] Even passive support for technology adoption could slow growth, since other governments largely do support it.

Governments have an opportunity to achieve a win–win result through technology and automation: enabling adoption while ensuring universal benefits (Exhibit 3).

Exhibit 3

Governments play an active role in ensuring an inclusive Future of Work.

Scenarios for potential outcomes of automation, by pace of adoption and effectiveness of policies to share gains

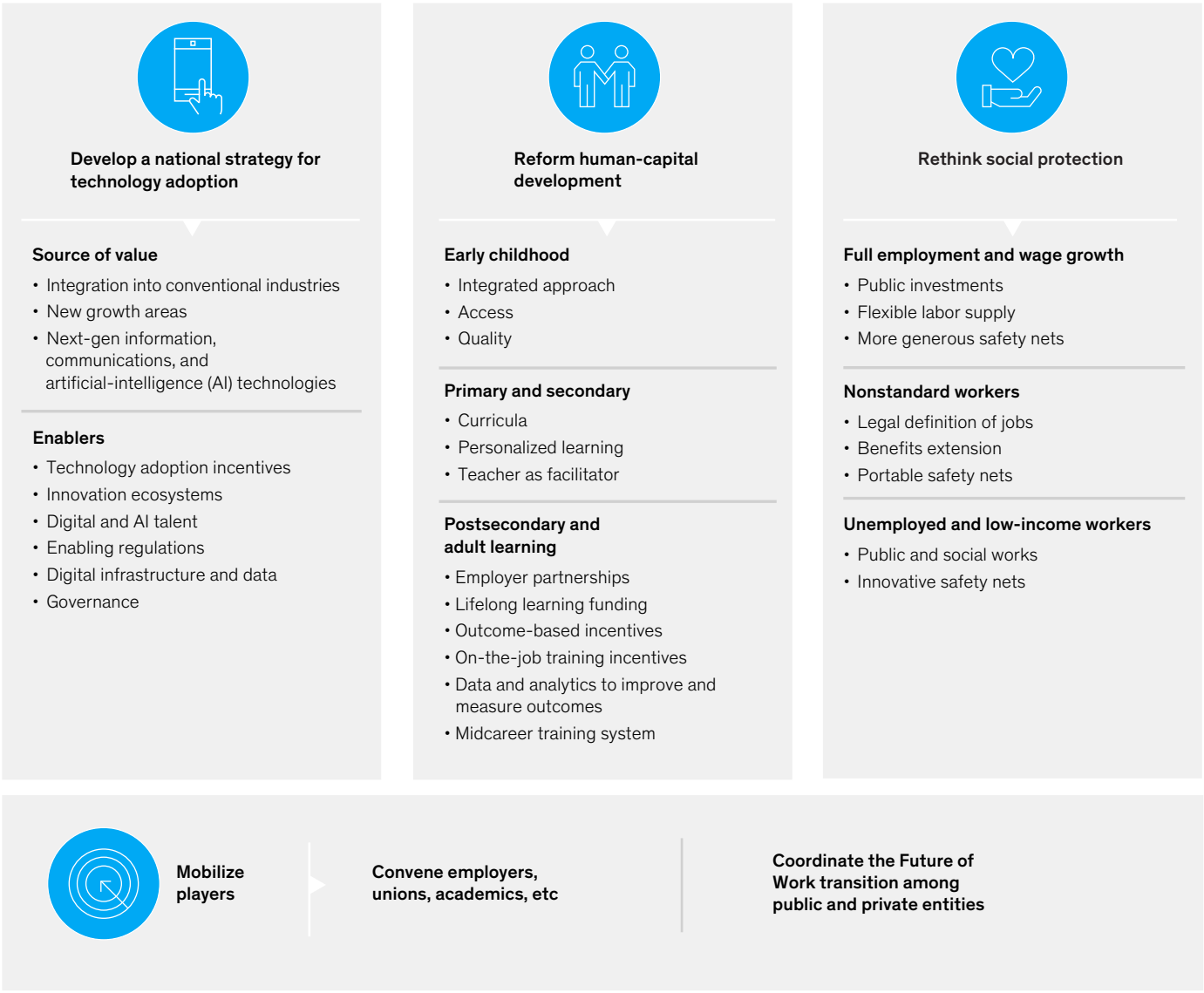


A blueprint for a smooth, win–win Future of Work transition

Governments have an important role to play in four areas: developing a national technology-adoption strategy, reforming the human-capital development system, strengthening social protection to ensure universal benefits from automation, and convening and mobilizing all stakeholders to play their part in the Future of Work transition (Exhibit 4). The rest of the section will explore these areas and corresponding levers.

Exhibit 4

A blueprint can help governments achieve a smooth Future of Work transition.


Develop a national strategy for technology adoption
Source of value
• Integration into conventional industries
• New growth areas
• Next-gen information, communications, and artificial-intelligence (AI) technologies
Enablers
• Technology adoption incentives
• Innovation ecosystems
• Digital and AI talent
• Enabling regulations
• Digital infrastructure and data
• Governance
Reform human-capital development
Early childhood
• Integrated approach
• Access
• Quality
Primary and secondary
• Curricula
• Personalized learning
• Teacher as facilitator
Postsecondary and adult learning
• Employer partnerships
• Lifelong learning funding
• Outcome-based incentives
• On-the-job training incentives
• Data and analytics to improve and measure outcomes
• Midcareer training system
Rethink social protection
Full employment and wage growth
• Public investments
• Flexible labor supply
• More generous safety nets
Nonstandard workers
• Legal definition of jobs
• Benefits extension
• Portable safety nets
Unemployed and low-income workers
• Public and social works
• Innovative safety nets
Mobilize players
Convene employers, unions, academics, etc
Coordinate the Future of Work transition among public and private entities

1. Defining a national strategy to enable technology adoption

In many OECD countries, concerns are growing that technology adoption is moving too slowly, leaving companies without the workers needed when baby boomers retire. Any government blueprint on the Future of Work must include a strategy to expedite technology adoption and ignite a new cycle of productivity growth.

Indeed, companies have only been able to capture a small portion of the value from existing digital and AI technologies. The MGI Industry Digitization Index shows that even the most digitally advanced nations have a large gap in their digitization levels compared with the theoretical potential.[24] AI adoption is lagging behind even further. In 2017, MGI interviewed more than 3,000 C-suite executives across ten countries and found that only 20 percent had adopted at least one AI-related technology at scale or in a core part of their business, and only 9 percent had deployed machine learning.[25]

Most technology-driven productivity growth is linked to digital technologies, with several applications enabled by AI. So it is unsurprising that many governments have created digital economy strategies, AI country strategies, or both. The government of Singapore, for example, developed a digital economy blueprint in 2016 and an AI strategy in 2017.[26]

Countries with AI strategies include Canada, China, Finland, France, Germany, Japan, Sweden, the United Arab Emirates, and several additional OECD countries. Such plans will differ significantly depending on a country's size, stage of development, and demographics, but governments of all nations can benefit from a well-thought-out strategy.

In developing such strategies, governments can consider three modes of creating value:

— *The adoption of digital and AI technologies by existing businesses in conventional industries.* Companies can achieve higher productivity and thus higher value-added per worker by either increasing the value of their products or by decreasing the costs of their production and service delivery.

— *Ecosystem players in new growth areas.* These companies—often new start-ups—use a disruptive digital or AI application to create new business models that change industry boundaries and capture value within ecosystems. Fintechs, ride-hailing or home-sharing platforms, and telemedicine are examples of new growth areas in banking, mobility, travel, and healthcare ecosystems. These models often create higher value for customers in a more productive way.

— *The development and improvement of next-generation digital and AI technologies.* In national strategies, governments can prioritize and actively support the development of opportunities like remote surgery and technologies such as deep learning, quantum computing, or 5G. For instance, Dubai has set targets to 3-D print complex items (such as prosthetic limbs and teeth) and to produce 25 percent of every new building with 3-D printing by 2025, with the goal to become the world's 3-D printing hub by 2030.[27] Likewise, the United Kingdom established the Catapult Programme to work with firms on advanced technology and to develop innovative ideas into marketable products. Each Catapult center specializes in a different field, such as cell and gene therapy or future cities, and provides access to R&D facilities and expertise.[28]

The Portuguese government reignited its start-up ecosystem, now ranked 29th in the world, with initiatives such as StartUp Visa and €200 million in public start-up funding and incubation programs.

Governments can help capture these sources of value through six enabling initiatives.

Offering technology adoption incentives. Several governments provide incentives to companies adopting productivity-enhancing technologies. For instance, South Korea offers tax relief for innovative technology companies working in special R&D zones, real estate of certain corporate research centers, cost of research and HR development, and employment of foreign technology experts.[29] In the Netherlands, the Innovation Box program requires companies to pay a tax rate of only 7 percent on income from intangible assets, including technological innovations.[30] The country also provides tax breaks and inexpensive loans for new product development, production techniques, and software as well as cash grants for public–private R&D partnerships.[31] Similarly, Italy gives tax breaks for R&D expenses and amortization of up to 250 percent for costs incurred to digitize operations; 56 percent of companies adopting Industry 4.0 technologies declared using at least one of the public incentives.[32] And Singapore's Productivity Solutions Grant reimburses 70 percent of the costs that eligible companies incur to adopt preapproved productivity solutions, including IT solutions, equipment, and training.[33]

Establishing thriving innovation ecosystems. Ideas, academic research, and even business intellectual property face a long path to value creation through industry applications, new start-ups, or licensing solutions. Governments can support the development of innovation ecosystems by bringing together multiple players and providing them with resources like work spaces, networks, incubators, venture capital firms, and public funding. Innovation districts, hubs, and start-up ecosystems are emerging across countries.

Of the $15.2 billion invested in AI start-ups in 2017, almost 90 percent came from China and the United States, with close to 50 percent in China alone.[34] The Chinese central government has supported the creation of 17 AI technology–demonstration hubs and poured public investments into more than 1,600 tech incubators.[35]

Other governments have also actively supported the development of start-up hubs, some of which focus on AI. The Canadian government has invested $500 million in the Montreal AI hub and created tax incentives for the investments, training, and personal income of foreign researchers and experts moving to Quebec. Incubators, corporate labs, and a thriving academic research environment complete the hub's value proposition.[36] Comparably, the Jurong Innovation District in Singapore focuses on R&D and adoption in the space of Industry 4.0, with several model factories, including the advanced remanufacturing and technology center, operated as a public–private partnership (PPP) ecosystem.[37]

Besides start-ups, small and medium-size enterprises (SMEs) can also benefit from such ecosystems by attending industry-specific programs that test digital technologies before deploying them in facilities. Finland is pursuing this type of goal, helping SMEs adopt AI technologies by enrolling them in a six-month program at an AI accelerator where a consortium of 15 companies provides funding and technical assistance.[38]

In the United States, Virginia Tech is developing a $1 billion "Innovation Campus" that will focus on the production of tech talent, with specialization in software development, machine learning and AI, and cyber security, among others. The Tech Campus was central to Virginia's bid for Amazon's HQ2 relocation; the company ultimately selected Northern Virginia for more than 25,000 new jobs.

Many innovation ecosystems are anchored by a university and are already researching ways to apply technology solutions to increase productivity and solve future challenges. Governments could take note and help turn many universities into innovation hubs by encouraging academia–industry collaboration to increase quality research outcomes and reduce time to market for technologies.

Focused digital and AI talent. Tackling the skill mismatch challenge requires reforms throughout the education ecosystem, but workers with digital and AI skills are particularly crucial to promote technology adoption today. Nations need people who can identify opportunities for digital and AI applications to products and processes. Governments can try to attract candidates from the global talent pool, but they could achieve greater impact by investing in basic and advanced digital training to develop their own promising candidates.

In Finland, for instance, the government realized it could not compete with China or the United States in developing advanced AI algorithms. Instead, it focused on becoming a world leader in practical applications. Hence, in 2018, consulting agency Reaktor and the University of Helsinki created "The Elements of AI," a free online training course.[39] The original goal was for 1 percent of residents, or 55,000 people, to pass the course; by March 2019, 15,000 had done so. At the same time, the course spread globally, and 150,000 students in 110 countries enrolled.[40] The agency AI Innovation of Sweden adopted it as well, with the aim of educating 100,000 Swedish residents in AI.[41]

Elsewhere, governments promote the development of AI skills. The European Union supports AI master's and doctorate degrees through scholarships and has launched a Digital Opportunity Traineeships program, which establishes internships to provide people with digital skills. France plans to double the number of AI graduates in five years by offering new relevant courses and hybrid programs (such as AI law);[42] the United Kingdom offers industry-financed AI master's courses;[43] and Germany intends to integrate core AI modules into engineering, applied science, and natural science programs. The United States has developed industry-recognized AI apprenticeships with companies, skills programs, fellowships, and education in computer science.

Japan's government will not only subsidize working adults who complete AI university courses; it also plans to let all students at universities and technical colleges take beginner courses on AI. Further, AI Singapore is offering an "AI for Industry" program for engineers and software developers. And Abu Dhabi has announced the launch of the first AI university.

Balanced regulatory environment. Uncertainty over regulations can deter innovation, especially in the space of AI, where ethical considerations are also involved. For example, companies need assurance about the requirements for removing bias from AI applications based on training data, explaining the rationale for AI decisions, and setting limits on the kinds of decisions that can be left to AI. Ideally, some of these regulations would be defined on a transnational basis to ensure a level playing field between companies operating internationally, but individual governments can start by setting their own ethical standards and regulations. Denmark, for example, recently introduced six ethical principles for the development and adoption of AI.[44]

Governments can also pursue data-protection policies that strike a good balance between safeguarding privacy and allowing profitable data usage and sharing. Fostering innovation through regulatory sandboxes—an approach that allows live, time-bound testing of innovations under a regulator's oversight—can help governments gauge whether emerging applications satisfy the often-complex rules. The United Kingdom launched the first sandbox in 2016; start-up Fractal, which has since exited the sandbox, has raised $200 million in investments for its AI firm efficiency tool.[45] Sometimes providing a confined test bed or helping innovators to define their regulatory barriers is sufficient on its own, for instance.[46] Singapore has been a test bed for several innovations, including autonomous vehicles and many breakthroughs in the digital infrastructure space.[47]

Digital infrastructure and data collection and sharing. Governments have a major role to play in enabling fast connectivity and gathering and managing data, and many governments are mobilizing. In 2014, the Singapore government dedicated the Jurong Lake District as a pilot area for more than 15 innovations, such as adjusting streetlight timing and issuing parking tickets through high-tech cameras. The test required installing more than a thousand sensors and multiple government agencies to use the same data-collection infrastructure.[48] Singapore is now creating a Smart Nation Sensor Platform to accommodate projects such as smart lampposts, citizen-centric apps, autonomous cars, e-payment systems, and online-transaction safety.[49]

In May 2019, the Chinese government announced that it would be the first country to roll out 5G, launching the technology in 40 cities on October 1.[50] The United Kingdom plans to have full fiber broadband that reaches the entire country by 2033 and provide 5G network coverage to the majority of the public.[51]

Besides data collection, classification and access are essential to make the most of digital and AI capabilities. By creating data standards and making large amounts of public sector data available to private companies, a government can support the training of neural networks and increase the viability of more AI applications. The European Union is trying to complete its digital single market, aiming for data to be accessible across countries at a scale that can double the data economy from 2 to 4 percent of the GDP in five years.[52] Proposals include the reuse of public-sector information, the access and preservation of scientific information, and guidance on sharing private-sector data in B2B and business-to-government contexts.[53]

Israel invested €255 million to establish a healthcare database that companies and researchers can use to develop AI applications and prevent disease.

Supportive government institutions and councils. The development and maintenance of all the initiatives, programs, and regulations often require an upgrade in governing institutions. For instance, the United Arab Emirates appointed a minister of AI as part of its National Program for AI. It also established an AI council to propose policies to build an AI-friendly ecosystem, advance research, and promote PPPs, including with international institutions. The e-Estonia Council guides the development of the nation's digital society, with a special focus on implementing its digital agenda.[54] Likewise, the Israel Innovation Authority provides practical tools and funding platforms to meet the varied needs of its vigorous innovation ecosystems.[55]

Governments around the world can also lead by example by deploying digital and AI technologies in their internal processes and services. Such initiatives would not only boost technology awareness and understanding of the implementation challenges among policy makers but also save significant public resources that can be reinvested in the Future of Work transition agenda. For example, Estonia's digital ID system is saving around 2 percent of GDP a year.[56] More than 100 public agencies are upgrading their ways of working, developing training programs on skills such as "digital collaboration and interaction," and reviewing their recruiting strategy to attract digital talent.[57] Governments could quickly adopt a

Through X-Road, Estonia built a secure data-sharing environment that enables agencies to manage and exchange data efficiently and citizens to use a single sign-in and submit any data only once.

"digital by default" policy, in which agencies must justify why their services aren't digital and automated.

2. Reforming the human-capital development system

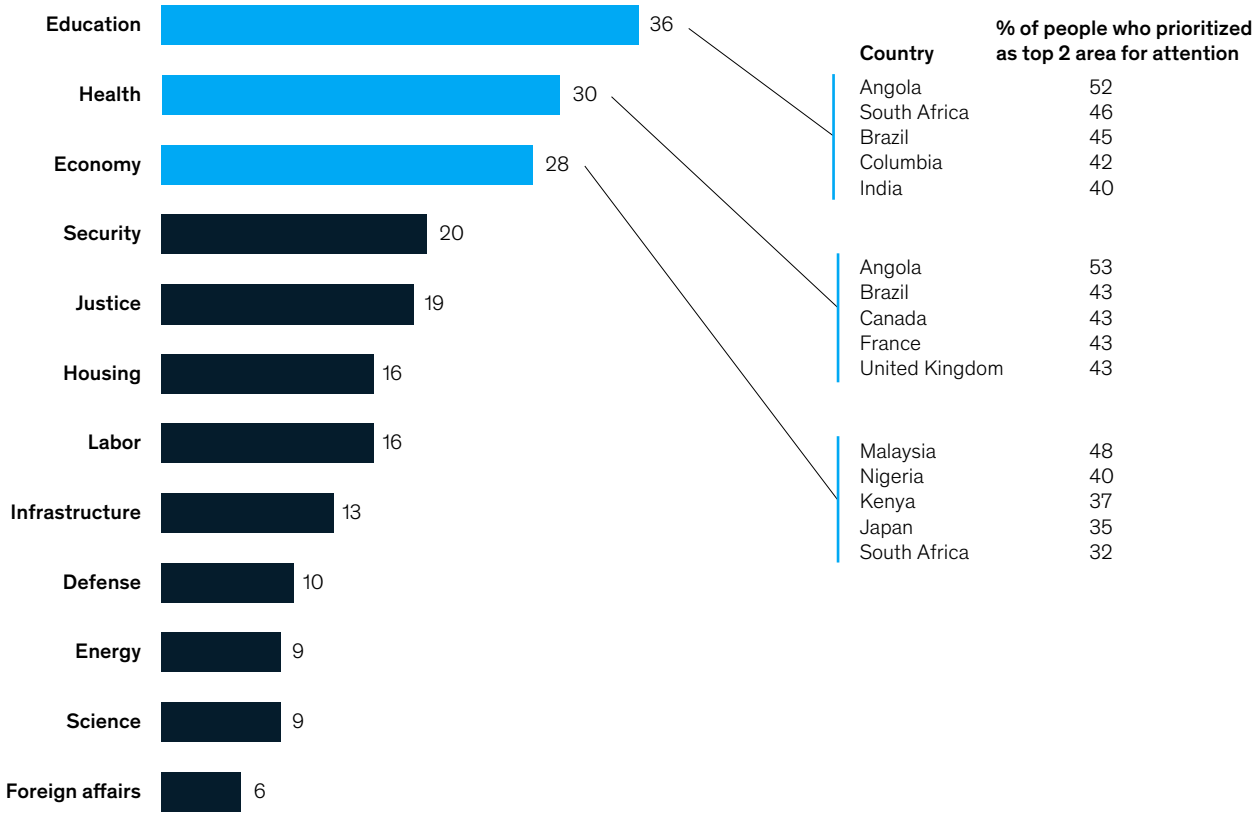
MGI found that up to 14 percent of the global population will need to change occupations by 2030.[58] The OECD found that 14 percent of jobs are at high risk of automation, and an additional 32 percent could be radically transformed.[59] Once adopted, the pace of AI diffusion within companies would follow an S curve, with displacement rising slowly at first but accelerating abruptly in the second half of the 2020s. Workers can expect their jobs to constantly change, and many might have to switch occupations several times in their working lives. In such increasingly dynamic labor markets, the 20-year education, 40-year career model becomes obsolete. Education will progressively be a lifelong endeavor, requiring significantly reformed development of human capital.

Governments are responsible for designing and coordinating the transition, regardless of whether a country's education providers are primarily private or public. In our global citizen survey, respondents named high-quality education as the number-one priority to improve the lives of the next generation (Exhibit 5).

Exhibit 5

High-quality education is citizens' first priority for uplifting the lives of the next generation.

Department, % of people who prioritized as top 3 area for attention



In addition, 57 percent cited the provision of education as a public-sector responsibility.[60] The latter majority holds across all sociodemographic segments. At the country level, the only exceptions are citizens in Kazakhstan and Poland, which are still near a majority, at about 47 percent.

Even though today's adults are those in most urgent need of training, the shift to a lifelong learning model of education requires reformed training from early childhood to adulthood (Exhibit 6).

Exhibit 6

Available educational measures have potential to reform the human-capital development system, from early childhood to adult education.

Tools and examples

Early childhood education (ECE)[1]

- **Access:** Ensuring affordability and adequate number of seats to accommodate all children

  Norway allocates 2% of GDP to ECE (more than 2× OECD average) and can fulfill ECE demand for all children

- **Quality:** Ensuring ECE centers can develop key cognitive and meta skills in children

  Denmark pays more than $50,000[2] to ECE teachers

- **Parental engagement:** Ensuring awareness of importance of ECE and education on infant care

  New South Wales launched a campaign on the need for 600 hours of ECE per year

Primary and secondary

- **Curricula:** Redirecting curricula focus to skills most in demand and difficult to automate

  Finland is shifting emphasis from subjects such as geography to problems such as climate change

- **Personalized learning:** Deploying technology to tailor content and free up teachers' time to facilitate and coach

  AI applications can grade tests, identify learning patterns, and release new content when the student is ready

- **Teachers as facilitators:** Moving from instructor toward academic facilitator and development coach

  The leerKRACHT foundation uses collaborative lesson planning and peer observation to improve teaching

Postsecondary and adult learning

- **Employer training partnerships:** Partnering with employers to develop curricula and on-the-job training

  Generation works with employers to cocreate the curriculum, and students gain hands-on skill practice through simulations and role-playing

- **Funding lifelong learning:** Providing funds to citizens for education that isn't provided by employers

  Singapore provides 500 Singapore dollar credits[3] to citizens that can be used to pay for selected courses

- **Outcome-based funding:** Giving funding to providers based on achieving better employment and wage outcomes

  Finland will shift to a 50% outcome-based funding of vocational-education-and-training providers by 2022

- **On-the-job training:** Offering incentives for employers to develop skills that help people stay employable

  Denmark salaries are subsidized for adults participating in an apprenticeship program

- **Data and analytics:** Using data to improve matching, reduce dropouts, measure outcomes, etc

  AI-powered headhunter Helena helps people find jobs that match their skills best

- **Midcareer training systems:** Defining portable and staggered credentials and worker-friendly delivery models

  Harvard and MIT offer MOOCs[4] on programming, engineering, and communication

[1] Including childcare from 0 to 2 years old.
[2] Adjusted for purchasing power parity; 337,000 Danish krone.
[3] $368.
[4] Massive open online courses.

Norway allocates 2 percent of GDP (more than twice the OECD average) to ECE and can fulfill the demand from all children.

Access to quality early childhood education (ECE) must increase. In a labor market where people may need to change occupations as often as every three years,[61] the most important skills include adaptability, creativity, flexible thinking, and a positive attitude toward learning and taking initiative. As the level of automation rises, occupations will have a growing share of activities requiring "human" skills, including empathy, collaboration, and the ability to develop relationships. People cultivate many of these skills and mind-sets most effectively in early childhood, since 90 percent of brain and personality development occurs before age five.[62] ECE yields the highest return on investment compared with spending on education in later years, and it is a powerful means of improving equality of opportunity and social outcomes for citizens.[63] Children without quality ECE start K–12 with already inhibited learning throughout their education.[64]

However, access to ECE is chronically insufficient. In OECD countries, only 32 percent of children aged zero to two years had access to ECE, and demand far outpaces supply in all countries but the Nordic region of Europe.[65] Variance between countries is high. In Denmark, for example, 65 percent of children from birth to two years have access to ECE as well as 97 percent of those from three to six years. The Danish government provides a childcare guarantee, which ensures children a place in childcare regardless of the employment situation of the parents. Meanwhile, half of the children worldwide lack access to pre-primary kindergarten.[66] On top of its importance for human-capital development, expanding access to ECE has the potential to create millions of jobs, both directly in the ECE ecosystem and indirectly by freeing the time of working-age parents. For example, considering only 34 percent of children under three years old have access to center-based childcare and ECE in the European Union,[67] approximately four million new jobs for childcare teachers could be created.[68]

Access to ECE must be complemented by high-caliber teaching, and governments need to ensure quality standards, licensing, monitoring procedures, and capability building of ECE teachers and staff. Our recent PISA analysis showed that low-quality ECE could be worse than having children stay home with caregivers.[69] Yet high-quality ECE teachers come at a cost. Denmark, for example, pays early childhood educators $50,000 a year in purchase parity terms (higher in absolute dollars).[70]

Last, governments need to ensure integration of ECE with healthcare provision, social services, and parental education. This integration is particularly important for low-income families that struggle to navigate the system.[71]

Primary and secondary education needs to improve and reform. While some education systems manage to develop high levels of literacy, numeracy, and critical thinking in their students, most systems still struggle to provide every child with that basic foundation.[72] Improving the quality and inclusivity of the K–12 education system becomes even more important in a world of automation. Governments must persevere through these fundamentals, especially if they remain in the "poor to fair" stage of the journey toward school system excellence. Even "good to great" systems can take steps to improve, especially in equity and inclusion. Our previous work has outlined what interventions are appropriate at each stage of that journey.[73] While not neglecting this foundation, three elements gain additional emphasis from the Future of Work: upgrading the curricula, personalized learning, and the central role of teachers as academic facilitators and personal coaches.

— *Curricula.* Besides explicit digital and STEM skills that have been in increasing demand,[74] children in K–12 need to develop the mind-sets, capabilities, and leadership traits that will be required in the labor market of the future. These include critical thinking, communication, self-awareness and self-management, entrepreneurship, and collaboration, among other interpersonal skills. The good news

is that cultivating positive mind-sets not only prepares students for their future careers but also improves well-being[75] and academic outcomes.[76] Above all, being prepared for constant change means students need to learn how to think critically and apply their knowledge to new situations.[77] Systems are experimenting in how to do this best. Finland's school system has begun to shift its emphasis from subjects, such as geography, to issues, such as climate change. Singapore has placed values—to nurture "a confident person, a self-directed learner, a concerned citizen, and an active contributor"—explicitly at the center of their curricula.[78]

— *Personalized learning.* Improving the capabilities of every child will require a more personalized, mastery-based approach to learning. This is easy to say, much harder to deliver. Although controlled studies have demonstrated academic gains from personalized blended learning,[79] implementation at scale has not fully delivered on that promise. Students who have access to laptops, tablets, and e-readers in the classroom perform worse on international assessments than those who do not.[80] Systems must ensure that technology integrated with curriculum is supported by teacher professional development and coaching. If done right, the potential gains are large. AI algorithms can help teachers understand existing student competencies and tailor content to each student. "Flipped learning" can enable students to cover content at home before the lesson (through videos), freeing up teacher time for in-person coaching on problems.

— *Teachers as academic facilitators and personal coaches.* As technology frees up time,[81] teachers will have more capacity for not only academic coaching but also personal coaching to help develop the whole child, including mind-sets, personalities, and self-leadership skills. This shift will have implications for educators' skill profiles, training, and selection process. Selective recruiting and attractive compensation have always been important factors to attract top talent,[82] as evidenced by the strategies of the best-performing and most-improved education systems, including Estonia, Finland, Singapore, and South Korea. The increased focus on education as part of preparing children for the 21st-century workforce underlines the importance of attracting talented candidates into teaching. Schools are then responsible for making the most of the teaching talent. The leerKRACHT foundation, for example, uses collaborative lesson planning, peer-observation and feedback, and listening to students to improve educational outcomes. This approach empowers teachers, rather than school administrators, to lead improvements. The initiative reached 10 percent of the student population in the Netherlands in 2019.[83]

Postsecondary education and adult learning requires urgent, ongoing reform. Companies in many countries already struggle to find the talent they need.[84] The mismatch between postsecondary education and market demand is likely to grow with the increased prevalence of digitization and AI.

Governments have three main segments of adult learners to consider: postsecondary students pursuing tertiary education, workers in occupations at high risk of automation, and the unemployed. For the first group, government can make high-quality education programs available and orient students toward those with the best outcomes. For workers at high risk of displacement, government can work through employers to provide upskilling and reskilling. For the unemployed, it can match people with the courses that provide the best chance for reemployment and make such courses available.

To succeed with such a broad agenda, governments will have to collaborate with education providers and employers, pursuing reforms along six lines: 1) establish employer partnerships; 2) incentivize employers to offer on-the-job training; 3) finance citizens' lifelong learning; 4) use data and analytics to improve and measure educational and labor outcomes; 5) shift toward outcome-based funding; and 6) reinforce the midcareer training ecosystem.

Aviva has a three-year partnership with Singapore's Infocomm Media Development Authority (IMDA) under the government-funded Techskills Accelerator (TeSA) initiative to enhance cloud-computing capabilities. Aviva trains cohorts comprising fresh hires and existing employees. Half of the fresh hires are released into the ecosystem for other companies to hire. IMDA finances part of the salary and training costs along with helping match fresh hires with prospective employers.

Establish employer partnership. Some technical and vocational education providers as well as universities have started to partner with employers on curriculum development, delivery in class or on the job, and placement of students in the same employers. Such partnerships often achieve the best outcomes by measures such as job placement, students, and employers' satisfaction. For example, Generation was launched in 2014 to train and place young people with no or limited working experience in 26 professions across four sectors. The students spend more than 70 percent of their time in the 4- to 12-week program focused on repeated, intensive practice of profession-specific skills and are guaranteed interviews with employers that have available vacancies. Eighty percent have a job within three months of graduation, and 98 percent of employers are satisfied.[85]

Government can enable PPPs with training providers and employers. Government entities are often both public training providers and employers, especially in industries where state-owned enterprises still operate a portion of economic sectors such as utilities, infrastructure, and aviation. The Technical and Vocational Training Corporation in Saudi Arabia, for example, has developed a partnership between the International Aviation Technical College and the Ministry of the National Guard on training and job placement for aircraft maintenance workers.[86] Large employers capable of providing meaningful practical experience to students may be in limited supply in emerging markets and in rural areas of developed markets. In those situations, virtual simulations, model factories, and serious games can provide a learning environment close enough to reality to provide practical experience in occupations as diverse as pilots, sales representatives, medical professionals, and maintenance workers. Governments can adopt these models to improve their education providers, but also provide incentives or financing to private education providers to invest in education capital.

Offer employers incentives to provide on-the-job training. Governments can also encourage employers to provide apprenticeship and on-the-job training programs to upskill and reskill their employees, especially for positions at high risk of automation. Some countries make apprenticeship a requirement. The Apprentices Act in India mandated all establishments with more than 40 employees to engage up to 10 percent of their workforce as apprentices for six to 48 months. In other countries, apprenticeship is incentivized rather than mandated. The US Federal Task Force on Apprenticeship Expansion is helping companies receive funding for apprenticeship programs with associated job guarantees. Denmark's apprenticeship program subsidizes salary payments for adults aged 25 and over, financed through a reimbursement fund in which employers contribute based on their use of apprenticeships.[87]

Singapore has several programs that offer on-the-job learning opportunities for students and midcareer workers, with grants for the companies of up to SGD 15,000 to provide structured on-the-job training.[88] Germany has struck a balance between compelling and motivating employers to train their employees, mandating that supervisors offer guidance to their direct reports while subsidizing up to 100 percent of training costs depending on company size.[89] A less-conventional example occurred in New Zealand, where the business council to the prime minister secured the commitment of several large employers to publish how much they spend on training and double the number of training hours per employee by 2025.[90]

Glassdoor can create public transparency about salary gaps between men and women.

It is often in employers' best interests to take a proactive approach to employee training, and many large companies already do so. When AT&T moved from a voice company to a data company, it invested in reskilling 100,000 employees—almost half of their total. Associates could also earn online college degrees through Georgia Tech, Coursera, and Udacity.[91] Walmart has spent $4 billion in four years to upskill its employees and improve both the customer experience and employee satisfaction.[92] They trained new frontline hires in retail and socioemotional competencies as well as managers and assistant managers in store operations and leadership.[93]

Finance citizens' lifelong learning. Employers' in-house training might cover only a portion of the necessary education, so governments can design more comprehensive programs that provide incentives directly to citizens. SkillsFuture in Singapore is an example: each Singaporean aged 25 and older has an initial credit of $500 toward courses ranging from cooking to advanced analytics. The government can provide periodic top-ups, and citizens can accumulate the credits.[94] To finance these training programs, employers pay a levy of 0.25 percent of the monthly remuneration for their employees in Singapore, with a maximum contribution per employee of SGD 11.25.[95] France has a similar model, with a personal training account where companies contribute up to 1 percent of payroll costs, and employees receive program hours in line with their working time. They can spend these hours on training that awards professional qualifications to meet the anticipated needs of the economy in the short or medium term.[96]

Use data and analytics to improve and measure educational and labor outcomes. Governments and the private sector hold vast amounts of education labor-market data they might consolidate and share. With updated data ownership and privacy regulations, these data sources can be used to improve education and increase employment.

For example, student dropouts and repeats are quite costly, both economically and socially. With the prompt use of data and AI algorithms, schools could predict when a student is likely to drop out and provide individualized support. They could also identify systemic issues causing high dropouts, such as teaching technical skills in a foreign language too early. Another example is platforms that access data and deploy AI algorithms to match people with training opportunities and direct workers to the jobs that fit them best. MGI estimates that by 2025, 540 million people could find better job matches through online talent platforms. It also estimates that about 230 million people could experience shorter job searches, with an overall impact on the global economy of $2.7 trillion, or 2 percent of global GDP.[97] The company Woo already has an AI-powered headhunter, Helena, that helps people find jobs to match their skills.

Though some data may not yet exist—or not exist at the right level of quality—governments can improve data creation. For example, both public and private sector organizations can track education results more thoroughly and identify the approaches and programs that work best for students, workers, and companies.[98] Most education systems do not monitor education results, especially outcomes such as time to employment, first-year salary, salary growth, or productivity growth from selected training programs. Greater transparency can help governments, training providers, and employers better allocate resources. Educators and vocational training providers can use such data to shape their offerings and be held to new standards of accountability, as the outcomes associated with specific institutions and degree programs become more transparent.

The German government has started to bring education and labor data to citizens through a career counseling platform for graduating students. Users can test their interests and attitudes, explore

opportunities in the job market, and gain the benefits of one-on-one counseling sessions. From the platform's May 2019 launch, 220,000 students have registered for the platform, and 38 percent have completed all the career counseling modules.[99]

Shift toward outcome-based funding. If governments increase funding to education providers with outcome-based models, they can better align training with the needs of both workers and employers. While outcome-based funding is often mentioned, its implementation can be complex. Measuring training outcomes is not as easy as tracking the number of students graduating. Furthermore, if too much funding is based on outcomes, education providers might start rejecting people that need the most training, cherry-picking students that are already most likely to find employment or secure higher salaries. The quality of teaching itself could even decrease if providers see their funding suddenly reduced because they are not delivering outcomes. Finland has already started a gradual journey to introduce outcome-based funding in vocation education training. Starting in 2002, 2 percent of funding was based on outcomes, before increasing in 2018. By 2022, 50 percent of funding for Finland VET providers will be based on the number of students, 35 percent on the qualifications achieved, and 15 percent on effectiveness, the latter of which will consider job placement rates and feedback from students and employers.[100]

Reinforce the midcareer training ecosystem. As people will have to continuously learn throughout their working life, the mix of time spent by people in education and training will shift toward adult training for midcareer workers. Governments must strengthen the adult training systems, especially for solutions that the market is least likely to develop.

Private and public education providers are already developing solutions for midcareer employees through worker-friendly education formats. California's community college system now includes a free online school to prepare people for work in healthcare.[101] Massive open online courses are free and open to anyone, and prestigious universities such as Harvard and MIT offer them on topics such as programming, engineering, and communication.

Governments can use existing public education networks and encourage private institutions to create alternative admission paths, programs, and services for experienced workers. Policy makers can also provide clear and portable credentials and promote their widespread use from bachelor's and master's degrees to more skills-specific qualifications. Besides facilitating matching and mobility between jobs, these credentials can be designed in a staggered way to create expertise paths, where adults can take short modular courses that add to their previous qualifications. In this way, learners can upgrade or specialize their development from novice to expert during their life.

3. Rethinking social protection systems

A win–win automation scenario is one in which benefits are shared broadly. Reforms to social protection systems would have to achieve three overarching objectives. The first is closing the gap between the growth in productivity and the growth in median wages, thus ensuring that additional income reaches workers and provides the purchasing power to sustain the virtuous cycle of higher aggregate demand, investments, and job creation. The second is increasing the portability of social protection benefits, both between jobs and between forms of employment. Most social protection systems do not cover alternative forms of employment, so many citizens who work the same amount of time—potentially for the same company and with the same occupation—may have widely different pensions, health insurance, paid holidays, parental leaves, or unemployment benefits. The third objective is providing more support to those not benefitting from automation: low-income workers and the unemployed. Even if jobs created exceed the jobs displaced

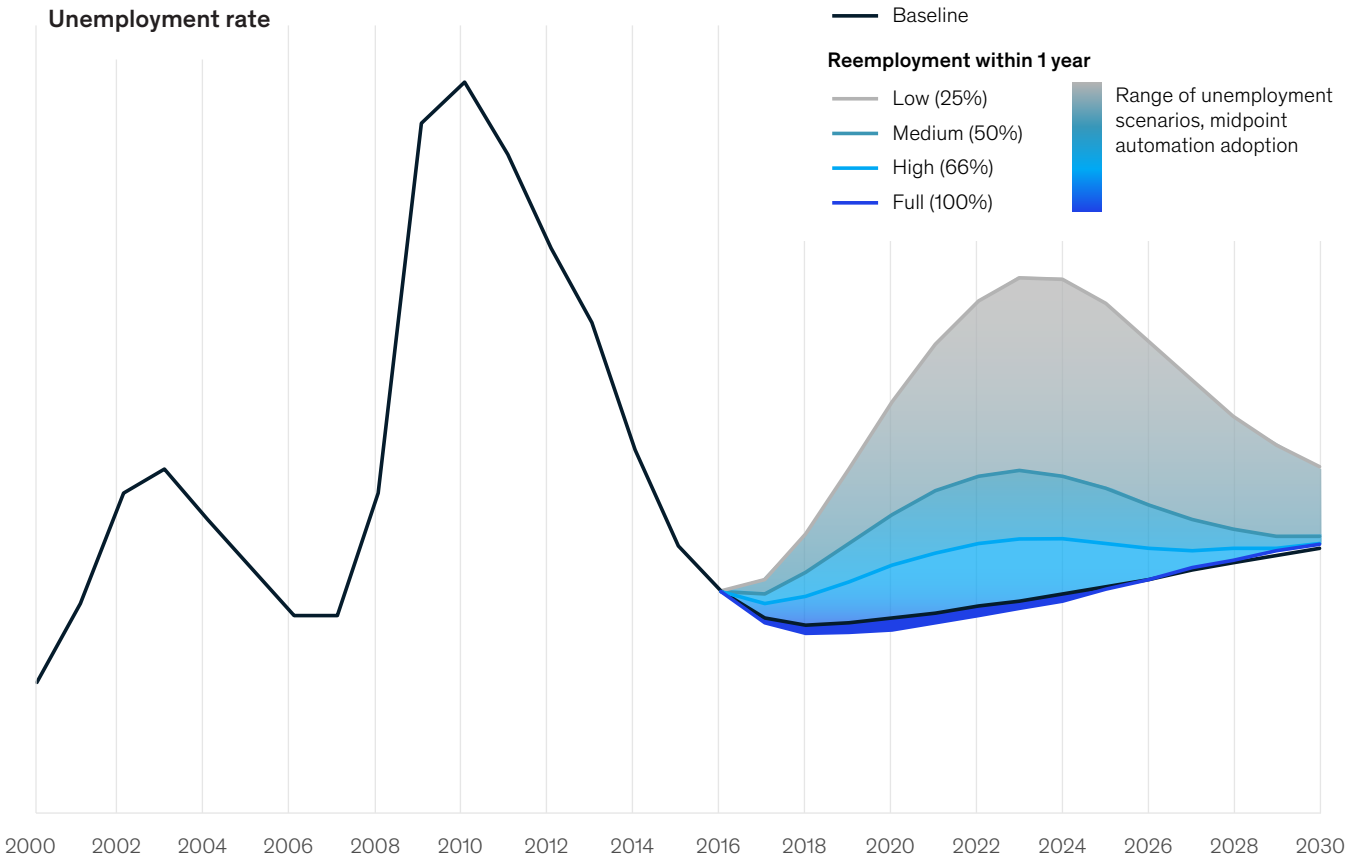
by automation, the faster pace of displacement and the longer reskilling and redeployment time requires protections that cover more people for a longer duration (Exhibit 7).

While it is necessary to balance workers' skills with employers' needs, closing the skill gap is insufficient to increase real median wages and protect independent and displaced workers. One of the challenges of social protection reforms is that they occupy the very fine line between economic and political or ideological reform. We will therefore provide options and highlight the latest innovations; however, technical considerations alone cannot set the path forward.

Help wages grow along with productivity. This pattern is typically associated with a tight labor market—one with low unemployment, underemployment, and NEET (not in employment, education, or training). The fewer underutilized people, the more employers would have to raise salaries to retain their workers or attract new ones. Recent evidence from the United States suggests that with fewer employees looking for work,

Exhibit 7

Unless displaced workers are reemployed quickly, medium-term unemployment could rise.

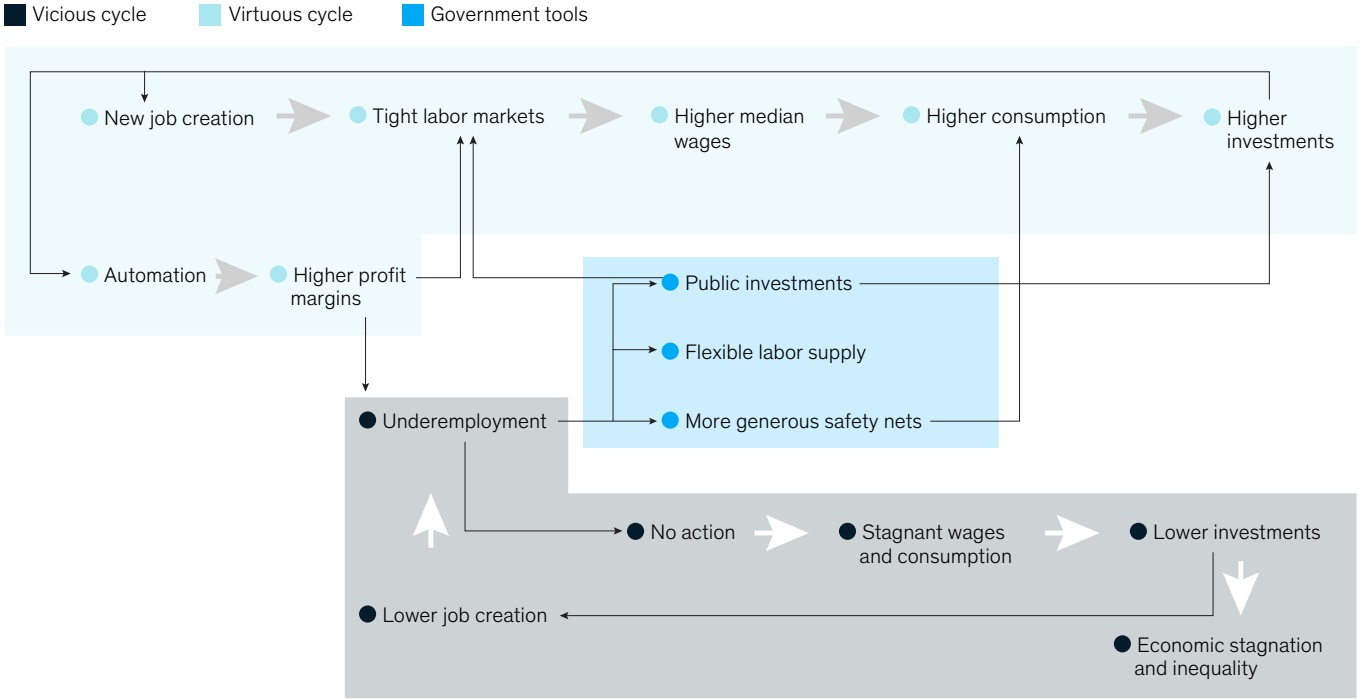


employers reduce skill requirements and invest in training new recruits.[102] Governments should not be passive players in achieving full employment and can shift the economy toward a virtuous cycle of increased productivity and inclusive growth (Exhibit 8).

The predominant macroeconomic response to economic slowdowns and recessions has been to increase government direct investments, compensating for the private sector's underinvestment. Economists Olivier Blanchard and, more recently, Mario Draghi have suggested that increased public investments and an expansive fiscal policy are needed to restore growth and full employment.[103] The low-interest environment provides a good opportunity to borrow at rates lower than the nominal growth rate of the economy, making the increased debt level sustainable without having to increase taxes later. Direct investments, tax cuts, or incentives for private-sector investments can all increase job creation, though the right combination depends on a country's circumstances.

Exhibit 8

Several factors can help create a virtuous cycle of increased productivity and inclusive growth.



If augmenting the demand for labor were insufficient, governments could also introduce incentives and policies to increase the flexibility in the supply. Business incentives that promote part-time work, independent work, shorter weekdays, leaves of absence (such as for education), or even early retirement can allow workers and employers to manage working hours depending on macroeconomic and individual circumstances.

A third option involves more generous safety nets, especially in cases of chronically weak labor demand or flat median-wage growth. These programs are thought to reduce the average number of hours that citizens are willing to work and could provide complementary funds to low-income earners. In the 1970s, pilots on negative income taxation (NIT) in the United States showed that if the transfer amounts were high enough, people would work fewer hours and dedicate more time to education, family, and other unpaid activities.[104] While reducing the labor supply is often considered a negative outcome, Germany and France have managed to cut average working hours significantly while maintaining the highest hourly productivity in the world. The average labor productivity in both nations was about €55 per hour in 2015. In addition, from 1991 to 2015, average annual working hours decreased by 12 percent (from 1,554 to 1,370) in Germany and by 7 percent (from 1,638 to 1,519) in France. Depending on citizens' preferences, governments could steer the increased productivity toward higher incomes or lower working hours.

Extend protection to nonstandard employment. This objective can be pursued through three levers. The first lever is regulation. For some forms of social protection and types of work, simply redefining a job can give nonstandard workers the same protections as employees. Some countries have attempted to narrow the legal definition of independent workers, forcing employers to recognize contractors as employees. The Italian government introduced stricter regulations to detect whether a person is self-employed by law yet economically dependent on an employer.[105] In an agreement between Denmark, one platform company's hundreds of cleaners (formerly self-employed) became employees and benefitted from the protections of EU and national labor laws.[106] In 2015, Romania revised its definition of the self-employed to exclude more de facto employees.[107] And Belgium has created a commission to determine whether self-employment is bogus or not and allows any party to submit a case.[108]

The second lever is policy. Governments can attempt to harmonize benefits across various forms of employment. For benefits the government already provides, such as pensions or unemployment support, policy changes are relatively straightforward; the main complexity is identifying those nonstandard workers entitled to benefits.

Employer benefits can be harder to change. For example, employment contracts often regulate parental leave. Ensuring that nonstandard workers have the same benefits as employees may require a shift to public provision, with significant fiscal consequences. For instance, since 2011, nonstandard workers in Australia have been eligible for government funds at the minimum wage for up to 18 weeks when they take time off to care for a newborn or recently adopted child. Providing sick-leave support to nonstandard workers is also complex. In Canada, self-employed workers can make voluntarily contributions to the Special Benefits for Self-Employed Workers program, which provides sickness benefits, among others. Austria offers an income-replacement program for short-term illnesses that self-employed workers can choose to join.

The Ministry of Manpower in Singapore offers a grant for companies to provide flexible work arrangements such as part-time work, staggered hours, job sharing, and telecommuting.

For some social protections, governments might make the case that only employees should benefit. Paid holidays, for example, may be irrelevant for the self-employed, since they have the flexibility to decide when to work. France seeks to handle the fiscal consequences of increased government

In New Zealand, self-employed individuals receive paid parental leave if they have worked 10 hours per week for at least 26 weeks during the year leading up to the arrival of the child.

support by linking employers' unemployment-insurance contributions to their rate of terminating contracts in a "bonus-malus" system. The proposal has so far focused on short-term employment contracts, but the concept can apply to any form of contract that decreases social protections.[109]

The third lever involves a shift to (or expansion of) safety nets that are independent of employment. This lever would also help achieve the objective of greater protection for low-income and unemployed individuals.

Greater protection for low-income workers and the unemployed. Governments are increasingly testing and implementing novel formats of safety nets that can better cater to the Future of Work. While in-kind benefits are important for particular beneficiaries and specific basic needs, many governments are testing cash transfer schemes that are simpler to administer and scale. Independent workers have much more volatile income profiles than standard workers, a fact that complicates means-testing procedures. Some people may be falling in and outside eligibility often, making in-kind support difficult. Furthermore, the monthly and annual wages of part-time and casual workers are often lower than the minimum income floor of some traditional safety nets, deterring people from these kinds of work.[110] If unemployment benefits grew more generous to compensate for the higher pace of worker displacement, the deterrence could become pronounced. Universal basic income (UBI) and NIT schemes can obviate both the inefficiency of means testing and the deterrence to part-time and casual work.[111] UBI and NIT experiments in some OECD economies and in developing nations (such as India, Kenya, Namibia, and Uganda) have shown no or limited effect on labor supply, with the exception of trials providing very generous transfers. In addition, they have produced several socioeconomic benefits, including increased entrepreneurship, improved educational attainment of low-income households, better mental health, and falling crime rates.[112]

UBI and NIT programs are typically unconditional, but given the growing skill mismatch in labor markets, governments could impose some training requirements for the unemployed. They could experiment more with these safety nets and push the boundaries of programs that have already achieved proven results. For example, Alaska's cash-transfer program began in 1982 and has shown that even small amounts can increase part-time work without decreasing full-time employment.[113] The earned income tax credit in the United States, a particular type of NIT provided since the 1970s, has helped alleviate poverty.[114] It could gradually be expanded to provide benefits to the unemployed.[115] France's Revenu de Solidarité Active program has evolved into a cash transfer with a profile similar to a NIT program.[116] The amount of the benefit varies with the family's situation and income: a single person with no income receives €551 per month, a couple without children €826, and a couple with two children €1,157. As a person earns income, the social transfer is decreased by less than the earned income, providing an incentive to earn. This fact distinguishes NIT programs from safety nets that pay low-income people the difference between their income and a set floor, implying a 100 percent marginal tax rate to any earning below the floor.

Finland provides €560 per month to 2,000 unemployed workers, on top of other forms of social protection. Recipients report higher well-being with no changes in the supply of labor.

In the long term, if technology and AI ultimately catch up with most human skills and reduce the need for labor, increasing cash transfers can help support the transition to a new economy that requires less human labor.

Some economists and technologists propose different approaches to providing income in an increasingly automated economy. Instead of expanding handouts, which risks stigmatizing the recipients and even depriving them of the pleasure and fulfillment of a working life, they propose a government job guarantee, which technologist

Kai-Fu Lee calls a "social investment stipend."[117] People who volunteer or perform similar socially useful work would receive the stipend. If the economy failed to provide enough jobs, they would still contribute to their communities and economies. The government of Hungary introduced a similar solution after the 2008 recession: it increased participation in the public works program significantly, which activated many people who had previously received cash benefits, and decreased the percentage of individuals living in extreme poverty.[118]

Besides new forms of safety nets, countries should expect the number of long-term unemployed individuals to grow (given the longer time needed to acquire new skills) and could design specific policies for this segment. Once people are outside the labor force for extended periods of time, employers often perceive them as risky, and they could become unemployable. The United States launched several programs after the Great Recession where private or nonprofit organizations could apply for funds and subsidies to develop programs that trained the long-term unemployed for vacant job postings.[119]

Depending on the direction and magnitude of government reforms, fiscal sustainability may need to be considered, if not radically restructured. A UBI program as generous as those piloted in high-income countries would require a significant increase in taxes if rolled out nationwide. Some fiscal reforms would also be necessary with a generous NIT, job-guarantee program, or just public expenditures to provide a larger number of people with unemployment benefits and reskilling. If a government were to increase access to childcare, early childhood development, and adult training, the cost to the public would also rise. Researchers have associated an increase in mental health issues with economic insecurity and the rise of automation, and this trend may also require government reforms.[120] The government of New Zealand, for example, introduced a well-being budget, with mental health receiving a large share of it.[121] Besides the amount of taxes, the forms of taxation would need to be revised, with trends such as the increase in gig workers and cross-border transactions calling for policy reforms.[122] The boundaries of the Future of Work extend much beyond education and labor—and beyond what the public sector alone can accomplish.

4. Convening and mobilizing society on a Future of Work road map

Several governments have begun bringing multiple stakeholders together, creating a dialogue with the aim of understanding the Future of Work and obtaining alignment on how to move forward. Denmark and Singapore have been at the forefront. Denmark's Disruption Council, chaired by the prime minister and including seven ministers and 29 members from civil society, has been studying the impact of automation on productivity and jobs. It identified the job profiles most in need of retraining and recommended harmonizing the benefits of nonstandard workers and platform contractors with regular employees. The government of Singapore established the Future Economy Council, chaired by the minister of finance and comprising members of industry, government, and unions. The council will oversee the implementation of other councils' recommendations covering economic growth clusters, skills development, and innovation. In some instances, the convening initiative has also been led by the private sector; two examples are the Business Advisory Council for the Prime Minister of New Zealand and the Wallenberg Foundations in Sweden.

In Washington State, a Future of Work task force with legislative, labor, and business members seeks to identify policies that help businesses and workers thrive in a rapidly evolving world.

Multipartite national debates are also important, considering that the Future of Work will have a different impact depending on national, cultural, and economic circumstances. For instance, in Japan, where the working population is declining and the economy is constantly at full employment, the top priority is adopting labor-saving technologies as fast as possible. In Ethiopia, Indonesia, Nigeria, and many other developing countries, the most important goal is finding a way to employ a growing population, while OECD nations reshore some of their production. The United States and others have flexible labor markets that can quickly adopt technology

but provide limited protection to displaced workers. In contrast, nations such as France or Italy offer more protection for workers, but their rigid labor markets may create barriers to the uptake of labor-saving technology. Convening multiple parties to craft a mutually beneficial road map could also reduce tension between groups.

Simply convening will not be enough, however. A key challenge to governments will be the coordination among multiple ministries, often with different agendas, each of which sees only one side of the Future of Work polygon. Some governments have opted for cross-ministry institutional arrangements, with an oversight capacity, an operational one, or both. The New Jersey Economic Development Authority, for instance, launched a Future of Work task force to plan and pilot creative solutions such as portable benefits and lifelong learning accounts to address the disruptive impact of technology.[123] Indiana created a Future of Work task force to report on innovative technologies and improvements in worker training that increase economic and individual growth.[124] In some cases, merging agencies may also improve collaboration. For example, some US states have combined their workforce, economic development, and commerce agencies.[125]

The Canadian government established and finances the Future Skills Centre, a diverse consortium of experts that identifies skills newly in demand and helps citizens acquire them.[126] The Future Economy Council in Singapore and the Disruption Council in Denmark oversee the implementation of similar initiatives.

The coming technologies will bring major discord in such areas as work, economies, and societal well-being. This article provides an overall blueprint with examples of how some governments are creating opportunities, minimizing social disruptions, and propelling their nations forward. Future articles will take a deeper look into some of the individual components of this Future of Work government blueprint.

Marco Dondi is a consultant in McKinsey's Dubai office, where **Dirk Schmautzer** is a partner and **Jörg Schubert** is a senior partner; **Solveigh Hieronimus** and **Julia Klier** are partners in the Munich office; and **Peter Puskas** is an associate partner in the Budapest office.

Endnotes

1 For a detailed analysis of technology adoption across sectors, see "'Tech for Good': Using technology to smooth disruption and improve well-being," McKinsey Global Institute, May 2019.

2 For more, see "Solving the productivity puzzle," McKinsey Global Institute, February 2018; "Can long-term global growth be saved?," McKinsey Global Institute, January 2015; "Testing the resilience of Europe's inclusive growth model," McKinsey Global Institute, December 2018.

3 "Solving the productivity puzzle."

4 "Notes from the frontier: Modeling the impact of AI on the world economy," McKinsey Global Institute, September 2018.

5 "Labour productivity growth in the total economy," OECD Productivity Database, November 28, 2013, oecd.org.

6 *World Population Ageing,* United Nations Department of Economic & Social Affairs, 2015, un.org.

7 For more, see "How artificial intelligence can deliver real value to companies," McKinsey Global Institute, June 2017.

8 Julian Kirchherr, Julia Klier, Cornels Lehmann-Brauns, Mathias Winde, *Future skills: Which skills are lacking In Germany,* a joint discussion paper from Stifterverband and McKinsey, stifterverband.org.

9 For more, see "Jobs lost, jobs gained: What the future of work will mean for jobs, skills, and wages," McKinsey Global Institute, November 2017; "Skill shift: Automation and the future of the workforce," McKinsey Global Institute, May 2018.

10 "Jobs lost, jobs gained."

11 Lia Ryerson, "10 jobs that won't exist 20 years from now," *Business Insider Australia,* March 8, 2019, businessinsider.com.au.

12 See Paul Burkander et al., *Providing public workforce services to job seekers: 15-month impact findings on the WIA Adult and Dislocated Worker Programs,* Mathematica, May 2016, mathematica.org.

13 See Jennifer Senior, "In 'Janesville,' when the G.M. plant closed, havoc followed," *New York Times,* April 19, 2017, nytimes.com.

14 For more, see "Inequality: A persisting challenge and its implications," McKinsey Global Institute, June 2019.

15 "Decoupling of wages from productivity: What implications for public policies?," *OECD Economic Outlook,* 2018, Volume 2018, Number 2, pp. 51–65, oecd.org; *OECD Employment Outlook 2018,* OECD, 2018, oecd.org.

16 "Inequality: A persisting challenge and its implications."

17 "Jobs lost, jobs gained."

18 "Jobs lost, jobs gained."

19 "Jobs lost, jobs gained."

20 Federico Cingano, *Trends in income inequality and its impact on economic growth,* OECD Social, Employment and Migration working papers, Number 163, December 2014, oecd-ilibrary.org.

21 Daron Acemoglu and Pascual Restrepo, *Automation and new tasks: How technology displaces and reinstates labor,* National Bureau of Economic Research working paper 25684, March 2019, nber.org.

22 Cara McGoogan, "South Korea introduces world's first 'robot tax,'" *Telegraph,* August 9, 2017, telegraph.co.uk.

23 "Testing the resilience of Europe's inclusive growth model."

24 Prashant Gandhi, Somesh Khanna, and Sree Ramaswamy, "Which industries are the most digital (and why)?," *Harvard Business Review,* April 1, 2016, hbr.org.

25 "How artificial intelligence can deliver real value to companies."

26 "Digital Economy Framework for Action," Infocomm Media Development Authority, updated September 4, 2019, imda.gov.sg; "Factsheet," AI Singapore, November 2018, aisingapore.org; Tim Dutton, "An Overview of National AI Strategies," Medium, June 28, 2018, medium.com.

27 "Dubai 3D printing strategy," Dubai Future Foundation, October 28, 2019, dubaifuture.gov.ae; Adam Jezard, "One-quarter of Dubai's buildings will be 3D printed by 2025," World Economic Forum, May 15, 2018, weforum.org.

28 "Our centres," Catapult, hvm.catapult.org.uk.

29 "R&D incentives," Invest Korea, investkorea.org.

30 "Innovation Box," Tax Consultants International, updated January 19, 2018, tax-consultants-international.com.

31 *Incentives & taxes 2019: Stimulating foreign investment and entrepreneurship in the Netherlands,* Invest in Holland, June 2019, investinholland.com; "WBSO - R&D tax credit," Netherlands Enterprise Agency, english.rvo.nl.

32 *Rapporto sulla competitività dei settori produttivi: Edizione 2018*, Italian National Institute of Statistics, March 2018, istat.it.

33 "Government grants for companies in Singapore," GuideMeSingapore, October 24, 2018, guidemesingapore.com.

34 *Top AI trends to watch in 2018,* CB Insights, cbinsights.com.

35 Meng Jing and Amanda Lee, "Where is China's Silicon Valley?" *South China Morning Post,* August 12, 2017, scmp.com.

36 *Artificial intelligence: World recognized hub,* Investissement Québec, investquebec.com.

37 "Jurong Innovation District," JTC Corporation, jtc.gov.sg; "About ARTC," Agency for Science, Technology and Research, a-star.edu.sg.

38 *Leading the way into the age of artificial intelligence: Final report of Finland's Artificial Intelligence Programme 2019,* Ministry of Economic Affairs and Employment of Finland, Competition and consumers series, Number 41, 2019, julkaisut .valtioneuvosto.fi.

39 Elements of AI, elementsofai.com.

40 Jan Petter Myklebust, "Democratising AI knowledge to inform ethical choices," *University World News,* April 13, 2019, universityworldnews.com.

41 AI Innovation of Sweden, ai.se/en.

42 "Artificial intelligence: 'Making France a leader,'" March 30, 2018, gouvernement.fr.

43 "Next generation of artificial intelligence talent to be trained at UK universities," February 21, 2019, gov.uk.

44 "Denmark decides on ethical principles for businesses working with AI," Invest in Denmark, October 4, 2019, investindk.com.

45 Ryoji Kashiwagi, "The rise of the regulatory sandbox," *Financial IT,* December 4, 2017, financialit.net.

46 *Regulation and Governance,* a joint report from Future Cities Catapult and Hyperconnected, August 2018, futurecities.catapult.org.uk.

47 "7 technological advancements that make Singapore a smart city," IoT For All, November 22, 2019, iotforall.com.

48 Irene Tham, "Jurong Lake District to be test bed for 'smart nation,'" *Straits Times,* June 18, 2014, straitstimes.com.

49 "10 tech developments to look forward to in 2019," GovTech Singapore, December 10, 2018, tech.gov.sg.

50 He Shusi, "China to start commercial 5G services on October 1: Industry leader," *China Daily,* May 16, 2019, chinadaily.com.cn.

51 "Forging a full fibre broadband and 5G future for all," July 23, 2018, gov.uk.

52 Defined by the European Union as the generation, collection, storage, processing, distribution, analysis, elaboration, delivery, and exploitation of data enabled by digital technologies; see *European Data Market: SMART 2013/0063,* a joint study from IDC, Open Evidence, and European Commission, February 2017, ec.europa.eu.

53 "Elements of the European data economy strategy," European Commission, updated April 25, 2018, ec.europa.eu.

54 "E-Estonia Council," Republic of Estonia Government Office, riigikantselei.ee.

55 Israel Innovation Authority, innovationisrael.org.

56 "Joining the e-State revolution: interoperability and digital identity, today," e-estonia, November 2016, e-estonia.com.

57 "Personal in der digitalen Verwaltung (PersDiV) - Ressortübergreifender Austausch geht 2019 weiter," Die Bundesregierung, Germany, verwaltung-innovativ.de.

58 "Jobs lost, jobs gained."

59 *OECD Employment Outlook 2019,* OECD, 2019, oecd.org.

60 Because of the question structure, the inverse should not be concluded from this result—that is, that 43 percent view education as a private-sector priority. Rather, these percentages refer to relative intensity or consensus on public-sector ownership.

61 See "Skill shift: Automation and the future of the workforce."

62 For example, see *World development report 2019: The changing nature of work,* World Bank Group, 2019, worldbank.org; "The Growing Child," Stanford Children's Health, stanfordchildrens.org; Deborah Phillips and Jack P. Shonkoff, *From neurons to neighbourhoods: The science of early childhood development,* first edition, Washington, DC: National Academies Press, 2000.

63 James J. Heckman, "Skill formation and the economics of investing in disadvantaged children," *Science,* June 2006, Volume 312, Number 5782, pp. 1,900–02; James J. Heckman et al., *A new cost-benefit and rate of return analysis for the perry preschool program: A summary,* National Bureau of Economic Research working paper, Number 16180, July 2010; Maureen Black et al., "Early childhood development coming of age: Science through the life course," The Lancet, October 2016, Volume 389, Number 10064, pp. 77–90.

64 Realizing human potential in the fourth industrial revolution: An agenda for leaders to shape the future of education, gender and work, World Economic Forum, January 2017, weforum.org.

65 "Enrollment in childcare and pre-school," OECD Family Database, May 11, 2019, oecd.org; "Early childhood education and care," Education Today 2010: The OECD Perspective, October 11, 2010, oecd.org.

66 A world ready to learn: Prioritizing quality early childhood education, UNICEF, April 2019, unicef.org.

67 Key data on early childhood education and care in Europe: 2019 edition, European Commission, 2019, eacea.ec.europa.eu.

68 About 30 million under three years old, with an average adult-to-pupil ratio of 1:5.

69 Alberto Chaia, Felipe Child, Emma Dorn, Marcus Frank, Marc Krawitz, and Mona Mourshed, Drivers of student performance: Latin America insights, September 2017, McKinsey.com.

70 Starting well: Benchmarking early education across the world, Economist Intelligence Unit, 2012, researchconnections.org.

71 Jimmy Sarakatsannis and Bryony Winn, "How states can improve well-being for all children, from birth to age five," October 2018, McKinsey.com.

72 Michael Barber, Chinezi Chijioke, and Mona Mourshed, How the world's most improved school systems keep getting better, November 2010, McKinsey.com.

73 Barber, Chijioke, and Mourshed, The world's most improved school systems.

74 Stella Fayer, Alan Lacey, and Audrey Watson, STEM occupations: Past, present, and future, US Bureau of Statistics, January 2017, bls.gov.

75 Alissa Goodman et al., Social and emotional skills in childhood and their long-term effects on adult life, Early Intervention Foundation, March 11, 2015, eif.org.uk.

76 Emma Dorn, Marc Krawitz, and Mona Mourshed, How to improve student educational outcomes: New insights from data analytics, September 2017, McKinsey.com.

77 Andreas Schleicher, "Educating learners for their future, not our past," ECNU Review of Education, March 2018, Volume 1, Number 1, pp. 58–75.

78 "Information sheet on 21st century competencies," Ministry of Education Singapore, April 1, 2014, moe.gov.sg.

79 Matthew D. Baird et al., Informing progress: Insights on personalized learning implementation and effects, RAND Corporation, July 2017, rand.org.

80 Etienne Denoël, Emma Dorn, Andrew Goodman, Jussi Hiltunen, Marc Krawitz, and Mona Mourshed, Drivers of student performance: Insights from Europe, April 2018, McKinsey.com.

81 Jake Bryant, Christine Heitz, Saurabh Sanghvi, and Dilip Wagle, "How artificial intelligence will impact K–12 teachers," January 2020, McKinsey.com.

82 Michael Barber and Mona Mourshed, How the world's best-performing school systems come out on top, September 2007, McKinsey.com.

83 New at McKinsey Blog, "What Dutch teachers are learning from their students," blog entry, April 4, 2019, McKinsey.com.

84 Dominic Barton, Diana Farrell, and Mona Mourshed, "Education to employment: Designing a system that works," January 2013, McKinsey.com; Müge Adalet McGowan and Dan Andrews, Labour market mismatch and labour productivity: Evidence from PIAAC data, OECD, April 28, 2015, oecd.org.

85 "Impact," Generation, generation.org.

86 For example, see "Technical and vocational training corporation to provide training in aircraft maintenance for Saudis," Arab News, April 2, 2018, arabnews.com.

87 "Company costs and benefits in Denmark," Apprenticeship Toolbox, apprenticeship-toolbox.eu.

88 "SkillsFuture work-study post-diploma," SkillsFuture, skillsfuture.sg.

89 Qualifizierungschancengesetz, "Qualification Chance Act," German Ministry of Labor and Social Affairs, December 2018, bmas.de.

90 Tim Newman, "Prime Minister Jacinda Ardern announces plan to increase skills and trade training," Stuff, May 2, 2019, stuff.co.nz.

91 Susan Caminiti, "AT&T's $1 billion gambit: Retraining nearly half its workforce for jobs of the future," CNBC, March 13, 2018, cnbc.com.

92 "Walmart's Sean Thurman on the future of work in the U.S.," Consumer Technology Association, March 11, 2019, prod3.cta.tech.

93 *2016 Global responsibility report,* Walmart, cdn.corporate.walmart.com; Tom Ward, "What is a Walmart academy? How they're building confidence and careers," Walmart, April 17, 2017, corporate.walmart.com.

94 "SkillsFuture credit," SkillsFuture, skillsfuture.sg.

95 "Skills Development Levy (SDL) System," SkillsFuture Singapore Agency, sdl.ssg.gov.sg.

96 "France: Employers obligation to provide skill development plans or training," Eurofound, October 10, 2019, eurofound.europa.eu.

97 For the full McKinsey Global Institute report, see "Connecting talent with opportunity in the digital age," McKinsey Global Institute, June 2015.

98 For more, see "Creating an effective workforce system for the new economy," McKinsey Global Institute, July 2018.

99 Interview with German Labor agency employees.

100 "Finland: New approach to VET provider financing uses student feedback," Cedefop, July 9, 2018, cedefop.europa.eu.

101 "Creating an effective workforce system for the new economy."

102 Greg Ip, "A record expansion's surprise winners: The low-skilled," *Wall Street Journal,* July 10, 2019, wsj.com.

103 Olivier J. Blanchard, "Public debt and low interest rates," the National Bureau of Economic Research, NBER working paper Number 25621, issued February 2019, nber.org; and Piotr Skolimowski, "Draghi says ECB has room to do more, but needs fiscal backup," *Bloomberg,* September, 29, 2019, bloomberg.com.

104 Ioana Marinescu, *No strings attached: The behavioral effects of U.S. unconditional cash transfer programs,* Roosevelt Institute, May 2017, rooseveltinstitute.org.

105 *Exploring the fraudulent contracting of work in the European Union,* Eurofound, 2016, eurofound.europa.eu.

106 Julian Hale, "In Denmark, a historic collective agreement is turning the 'bogus self-employed' into 'workers with rights,'" Equal Times, July 4, 2018, equaltimes.org.

107 *Exploring the fraudulent contracting of work in the European Union.*

108 *Independent workers and industrial relations in Europe, I-WIRE,* May 2017, i-wire.eu.

109 "Transformation of unemployment insurance and support for the unemployed," French Ministry of Labour, travail-emploi.gouv.fr.

110 The marginal tax rates for accepting a job are quite high. At some extremes, one could earn more unemployed than in a part-time job.

111 A negative income tax (NIT) is similar to universal basic income (UBI), though NIT benefits only people below a certain income level, resulting in a more affordable program. The combination of UBI and a more progressive income tax rate could make the two concepts economically equivalent.

112 Valentina Barca, Francesca Bastagli, Jessica Hagen-Zanker, Luke Harman, Luca Pellerano, Tanja Schmidt, Georgina Sturge, *Cash transfers: What does the evidence say? A rigorous review of impacts and the role of design and implementation features,* Overseas Development Institute, July 2016, odi.org.

113 Damon Jones and Ioana Marinescu, *The labor market impacts of universal and permanent cash transfers: Evidence from the Alaska Permanent Fund,* the National Bureau of Economic Research, NBER working paper, Number 24312, February 2018, nber.org.

114 Robert Greenstein and Isaac Shapiro, "New research findings on the effects of the earned income tax credit," Center on Budget and Policy Priorities, March 11, 1998, cbpp.org; Bruce D. Meyer, "The effects of the earned income tax credit and recent reforms," chapter in *Tax policy and the economy,* Volume 24, ed. Jeffrey R. Brown, the National Bureau of Economic Research, 2010, nber.org; and Margot L. Crandall-Hollick and Joseph S. Hughes, *The earned income tax credit (EITC): An economic analysis,* Congressional Research Service, August 13, 2018, fas.org.

115 The earned income tax credit does not cover unemployed people. Covering people who are not working would turn this program into the NIT programs piloted in the United States in the 1970s.

116 "Active solidarity income: 550.93 euros in June 2018 [Revenu de solidarité active : 550,93 euros en juin 2018]," Net-iris, May 31, 2018, net-iris.fr.

117 AI superpowers.

118 Luca Koltai, "The impact of public employment on the local economy and society," July 31, 2018, kozfoglalkoztatas.kormany.hu.

119 Jared Bernstein, "How to put the long-term unemployed back to work," *Washington Post,* June 25, 2019, washingtonpost.com.

120 Daniel Kopasker, Catia Montagna, and Keith A. Bender, "Economic insecurity: A socioeconomic determinant of mental health," *Science Direct,* Volume 6, December 2018, sciencedirect.com; and Karen Talley, "Rise of robots causing physical, mental distress," *FierceCEO,* June 12, 2018, fierceceo.com.

121 *The wellbeing budget,* New Zealand Government, May 30, 2019, treasury.gov.nz.

122 For more, see *How smart choices on taxation can help close the growing fiscal gap,* forthcoming on McKinsey.com.

123 The New Jersey Economic Development Authority Act, N.J. Stat. § 34:1B-1 (2014).

124 It consists of state senators and representatives, officials in the Indiana Department of Education and the Indiana Department of Workforce Development, and members of a variety of private entities. For more, see in.gov.

125 Lauren Eyster and Amanda Briggs, *State workforce and economic development collaboration,* Urban Institute, May 9, 2017, urban.org.

126 For more, see fsc-ccf.ca.

Copyright © McKinsey & Company. All rights reserved.

McKinsey.com